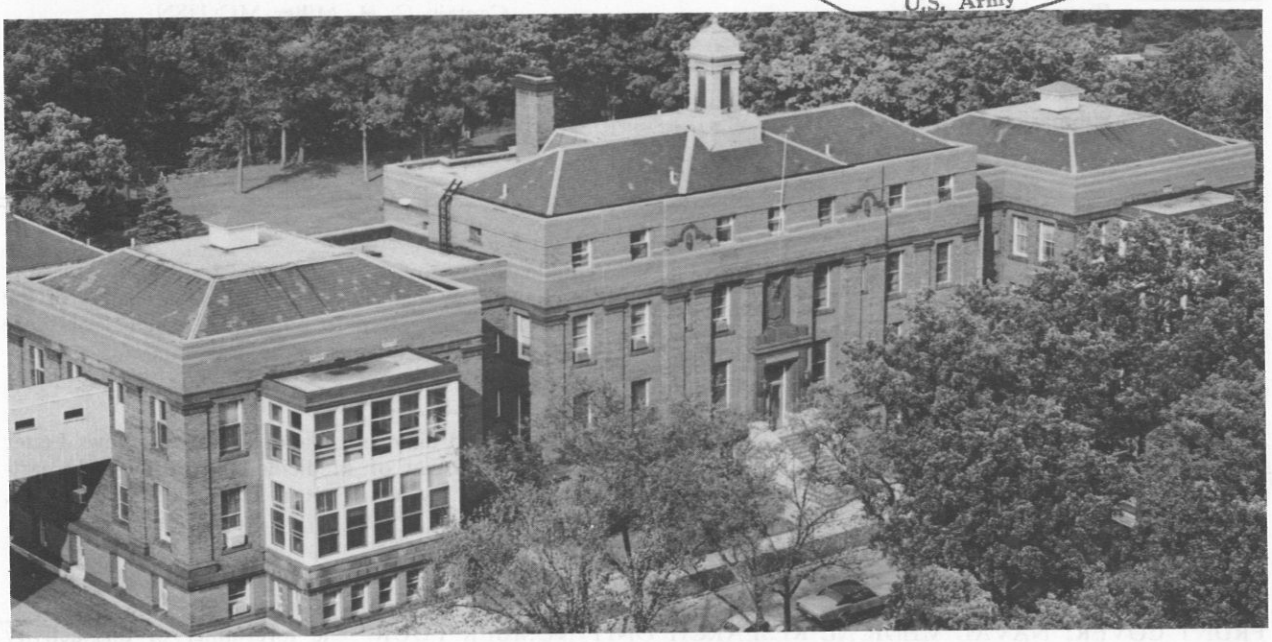
NAVMED P-5088

UNITED STATES NAVY
Medical News Letter

Vol. 51 Friday, 19 April 1968 No. 8



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Policy

The U.S. Navy Medical News Letter is basically an official Medical Department publication inviting the attention of officers of the Medical Department of the Regular Navy and Naval Reserve to timely up-to-date items of official and professional interest relative to medicine, dentistry, and allied sciences. The amount of information used is only that necessary to inform adequately officers of the Medical Department of the existence and source of such information. The items used are neither intended to be, nor are they, susceptible to use by any officer as a substitute for any item or article, in its original form. All readers of the News Letter are urged to obtain the original of those items of particular interest to the individual.

Change of Address

Please forward changes of address for the News Letter to Editor: Bureau of Medicine and Surgery, Department of the Navy, Washington, D.C. 20390 (Code 18), giving full name, rank, corps, old and new addresses, and zip code.

FRONT COVER: NAVAL MEDICAL RESEARCH UNIT NUMBER FOUR. The forerunner of this activity was established on 1 June 1946 at the Dublin Naval Hospital in Georgia as a rheumatic fever convalescent center. On 4 June 1948 NAMRU–4 was officially established at Great Lakes under the military command of the Naval Training Center and the management control of the Bureau of Medicine and Surgery. The mission was expanded to include research on the control and prevention of acute communicable respiratory diseases due to viral and bacterial agents in military personnel, especially the recruit population. On 27 June 1961 the Unit was moved to buildings at the Great Lakes Naval Hospital, and on 1 January 1965 became a separate BUMED command under an Officer in Charge with area coordination by the Ninth Naval District. Its present mission is to conduct basic research in the biomedical sciences, provide essential information on disease and medical problems of military significance, recommend control measures for communicable diseases that are endemic or epidemic to specific areas world-wide, and to give training when necessary in research techniques. Research is conducted on the etiology, epidemiology, pathogenesis, diagnosis, prevention, and treatment of acute respiratory diseases among recruits. Studies are made on the host-parasite-environmental relationships and on factors pertaining to natural as well as acquired immunity, and on the role of viruses, bacteria, mycoplasma, and other agents. Experimental animals, tissue culture, serological and biochemical procedures are utilized, and techniques are developed as needed. Vaccines, as well as drugs and antibiotics used in prophylaxis, are evaluated. The Unit performs streptococcal grouping and typing for the Navy at large and serves as a regional laboratory in the World Health Organization's Information Center Program. Current studies include development of methods for preventing and treating spinal meningitis, and a new nursing research project.

The issuance of this publication approved by the Secretary of the Navy on 4 May 1964.

EPIDEMIOLOGY OF TUBERCULOSIS ABOARD A SHIP

Mark A. Hardy, MD, and Henry H. Schmidek, MD,
JAMA 203(3):175–179, Jan. 15, 1968.

A one-year study of an outbreak of pulmonary tuberculosis was conducted aboard a ship with 1,175 men. Twenty-five cases of active pulmonary tuberculosis were discovered. Purified protein derivative of tuberculin, Seibert (PPD-S) skin tests were performed serially, and roentgenographic studies were performed at two-month intervals on 532 men chosen because of their close proximity to the three initial active cases of pulmonary tuberculosis. The rest of the ship's complement was studied similarly twice during the year. Tuberculin reactivity rate went from 14.3 percent to 53.6 percent among 532 men. All PPD-S skin test converters underwent complete clinical evaluations. Airborne infection is suggested by the rapid spread and extraordinarily high rate of tuberculin conversion. Particular consideration is given to the high susceptibility of tuberculin-sensitive young adult men. Studies of all contacts at frequent intervals are reemphasized as the best means of preventing the spread of pulmonary tuberculosis in a closed environment.

The outbreak herein described occurred aboard a US Navy heavy cruiser that was frequently deployed to the Mediterranean and the Caribbean seas. Between July 1964 and January 1965, the ship stopped in Turkey, Italy, Sicily, France, and Spain. The ship's complement included 1,175 men with an average age of 25 years; 80 of the men were officers. This study extended until August 1965, at which time the ship's complement changed significantly enough to warrant a new study. Detailed results were obtained on 532 patients at two- to three-month intervals, while the whole crew was studied twice during the year. Twenty-five cases of pulmonary tuberculosis were discovered and documented by sputum or gastric-washing cultures of *Mycobacterium tuberculosis*. Although not unique, this outbreak of tuberculosis afforded a rare opportunity to study the epidemiology of this disease under controlled conditions.

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The opinions or assertions contained in this article are those of the authors and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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Methods

The epidemiological study began after the discovery of two active cases of pulmonary tuberculosis in June 1964 on routine annual chest roentgenograms. The men, subdivided in groups as described later, were skin-tested with 0.0001 mg/0.1 cc of standardized purified protein derivative of tuberculin, Seibert (PPD-D) at two- to three-month intervals. Those with previous positive skin tests received 14 x 17 chest roentgenograms at the same intervals. To avoid local sensitization to tuberculin from previous skin tests, a new site was chosen for each subsequent test. Readings of skin tests were done at 48 and 72 hours by one of us.

A converter is defined in this study as one who had a negative PPD-S skin test and in whom there later developed 5 mm or greater induration to 0.0001 mg/0.1 cc of PPD-S. There were a few individuals who had no previous record of tuberculin testing and who had positive skin tests on the original testing; they were treated as converters but are not included in this study.

At a military hospital or aboard ship, all the converters underwent three-day studies which included complete histories, physical examinations, roentgenograms of the chest, laboratory studies including complete blood count, erythrocyte sedimentation rate (corrected), urinalysis, and cultures of three induced sputa and three gastric washings.

In June, with the discovery of the two original cases of pulmonary tuberculosis—patient 3 of E Division who had a pleural effusion of the left lung and patient 1 of S–5 Division who presented with an infiltrate of the upper lobe of the right lung—a study was begun on 226 men from the S–2, S–5, E, M, and H and D divisions, and officers. This

group will be referred to as group 1. It was originally assumed that the primary danger of spread of the disease was to the divisions that came in frequent contact with each other or shared the adjoining compartments. The study included officers because patient 1 was a stewart in the officer's mess.

In April 1965, patient 9 of the 2nd Division was discovered to have active pulmonary tuberculosis with a small cavity in the upper lobe of the right lung, when he presented with chronic cough productive of yellow sputum. Since the 2nd Division lived far removed from group 1, another group (155 persons) was placed on a follow-up study. This included the 1st, 2nd, and O–I divisions and will be referred to as group 2. The study again proceeded in this manner because of the close proximity of living compartments of the above divisions to each other. Group 2 was skin tested or had roentgenograms as appropriate in April, June, and in August.

In April, the study was extended to include another group (151 men) of the B, A, and R divisions, which will be referred to as group 3. The selection of this group was based on the close proximity of working conditions in the engineering divisions and upon the higher than expected rate of PPD-S conversion in this group during the testing of the whole ship's complement. Since E and M divisions (engineering divisions) were already under study, group 3, comprising the rest of Engineering Department, was also placed on the follow-up program.

In July 1964 and in April 1965, the whole crew was skin tested and received 70 mm chest roentgenograms. Sputa and gastric washings were obtained for acid-fast studies on all individuals with positive skin tests regardless of their division distribution and whether they had had previous positive skin tests.

Results

Table 1 presents the active cases of pulmonary tuberculosis discovered between July 1964 and August 1965. Age, race, date and size of induration of PPD-S conversion, and the symptomatic, physical and laboratory findings are summarized. The division and the group to which each man belonged are also indicated.

Group 1 consisted of H and D (hospital corpsmen); E Division, M Division (engineering); S–2 Division, S–5 Division (supply men and stewards); and officers. Table 2 shows the number of men in each division and their percentage of PPD-S conversion within the one-year period. It also presents the number of original positive skin-test reactors in each division at the beginning of this study. It is noteworthy that the S–5 Division was composed almost completely of Malayans or Negroes, and this is the only division in which all men had positive PPD-S skin tests on or before July 1964. (Patient 1, one of the original cases, was in the S–5 Division). The sudden rise in March 1965 may be explained by cavitary pulmonary tuberculosis discovered that month in patient 7 of the S–2 Division.

Group 2 consisted of the 1st, 2nd, and O–I divisions and was placed on the intimate contact study as a result of cavitary disease discovered in patient 9 of the 2nd Division. Table 3 shows the number of men in each division and their percentage of PPD-S conversion within the one-year period. It is reemphasized that group 1 (the original group studied) berthed far away from group 2. Careful histories revealed no close contact between patients 3, 1, 9, and 7, all of whom had sputum smears positive for acid-fast bacilli and roentgenographic evidence of advanced pulmonary tuberculosis.

Group 3 consisted of B, A, and R divisions (all engineering divisions). Table 4 shows the number of tuberculin reactors in each division and is presented similarly to Tables 2 and 3. It is important that B, A, and R divisions, being all engineering divisions, worked in close proximity to the men of M and E divisions. Reference to Table 1 reveals that five cases of active tuberculosis were found in group 3.

Comment

The preceding study illustrates the explosive and relentless spread of *M tuberculosis* in a closed environment. The original assumption that the infection would be confined to adjoining compartments was inaccurate. Seven patients with active tuberculosis did not belong to any of the previously described groups and were discovered only on testing all of the ship's complement. The majority of the active cases and a high percentage of tuberculin reactors belonged to the three groups that either berthed or worked in close proximity to patient 3 or patient 1 and later to patient 7 of group 1 or patient 9 of group 2.

In a closed environment such as a ship, many of the men had had association with each other across divisions, standing watches together, eating in the cafeteria, and working together during special exercises. Despite intensive questioning, no single source to account for all the cases could be found. It would appear most likely that there were two epi-

Table 1.—Cases of Active Pulmonary Tuberculosis Discovered During the Epidemic

Patient	Age, yr	Race	PPD-S: Date of Conversion	PPD-S: Skin Test, Size of Induration, mm	Clinical Findings	Chest Roentgenogram*	Laboratory†	Division/ Group
1	35	Malayan	6/62	20	Hemoptysis	RUL infiltrate	Sputum smears	S–5/1
2	36	White	4/64	11	Diabetes mellitus	LUL infiltrate	Sputum cultures	Off/1
3	28	White	6/64	15	Productive cough; 25 lb weight loss	L pleural effusion	Sputum smears	E/1
4	20	White	7/64	15	Asymptomatic	LLL cavity	Bronchial aspirate cultures	M/1
5	20	White	7/64	15	Productive cough; night sweats	RUL infiltrate	Sputum cutures; urine cultures	A/3
6	24	White	7/64	15	Weight loss; weakness; anorexia	Bilateral apical infiltrates	Sputum cultures	S–2/1
7	23	White	7/64	10	10 lb weight loss	RUL cavity	Sputum smears	S–2/1
8	24	White	3/65	13	Asymptomatic	Negative	Sputum cultures	Off/1
9	22	White	4/65	20	Hemoptysis; RUL pneumonia	RUL cavity	Sputum smears	2nd/2
10	19	White	4/65	10	Asymptomatic	Negative	Sputum cultures	B/3
11	22	White	4/65	16	Asymptomatic	Negative	Sputum and gastric cultures	2nd/2
12	20	White	4/65	10	Asymptomatic	Negative	Sputum cultures	B/3
13	21	White	4/65	10	Asymptomatic	Negative	Sputum and gastric cultures	B/3
14	19	White	4/65	8	Asymptomatic	RUL infiltrate	Sputum cultures	O–1/2
15	23	White	4/65	9	Asymptomatic	Negative	Sputum cultures	X/‡
16	25	White	4/65	8	Asymptomatic	R apical pleural thickening	Sputum cultures	A/3
17	27	Negro	4/65	15	Asymptomatic	Negative	Sputum cultures	S–1/‡
18§	23	White	4/65	8	Shortness of breath; L pleural effusion	L pleural effusion	L pleural biopsy positive for tuberculosis	8th/‡
19	20	White	4/65	7	Weakness; night sweats	RUL infiltrate	Sputum cultures	5th/‡
20	19	White	4/65	13	Asymptomatic	Negative	Sputum cultures	2nd/2
21	38	White	4/65	9	Productive cough	L apical pleural thickening	Sputum cultures	Flag/‡
22‖	37	White	4/65	14	Productive cough	RUL infiltrate	(Pulmonary tuberculosis at autopsy)	X/‡
23	28	White	5/65	14	Asymptomatic	Negative	Sputum cultures	H and D/1
24	21	White	7/65	10	Asymptomatic	? infiltrate RUL	Sputum cultures	M/1
25	30	Negro	8/65	14	Asymptomatic	L apical pleural thickening	Sputum cultures	S–3/‡

*RUL signifies upper lobe of the right; LUL, upper lobe of the left; L, left; LLL, lower lobe of the left; R, right.
†All positive smears and cultures refer to findings of *M tuberculosis.* ‡Cases discovered during whole ship's testing and not belonging to groups 1, 2, or 3.
§Patient discharged from the service, and investigations conducted in a community hospital.
‖Patient killed in automobile accident prior to thorough investigation. Postmortem examination revealed pulmonary tuberculosis. No cultures obtained.

demics, one originating with patients 3 and 1 in June 1964 and the other starting with patient 9 in April 1965. The clustering of tuberculin reactors and men with active tuberculosis around the original patients and a lack of random distribution are at variance with the results of Bates et al. These authors found in their study of tuberculosis in an industrial school, that new infections were distributed at random in two wings of a dormitory, and they, therefore, concluded that the infectious units were in the form of droplet nuclei rather than larger particles. Riley et al and Wells et al have already shown that the disease may be transmitted by droplet nuclei. Although no conclusion can be reached in our study on the means of transmission of tuberculosis, we believe that both rapidly settling, infectious particles, small enough to penetrate the alveoli of the lungs, and fine-particle, infectious aerosol were the infectious units. The forced-blower system and the continuous human flow of traffic offered ample stimulation for particulate resuspensions. The rapidly settling, infectious particles most likely played a contributing role in the transmission of infection within any given compartment.

Tables 2, 3, and 4 illustrate the relative degree of involvement of each division by exposure to an active disease carrier. Within one year, the tuber-

Table 2.—Percentage of PPD-S Conversion in Group 1

Division	Total	Positive PPD-S: Before 7/64	Positive PPD-S: On or after 7/64	Conversion in One yr, %
S–5	15	15	. . .	
S–2	27	7	17	85
E	39	5	30	88.2
M	51	8	30	70
H and D	14	2	8	66.6
Officers	80	15	13	20
Total	226	52	98	56.3

Table 3.—Percentage of PPD-S Conversion in Group 2

Division	Total	Positive PPD-S: Before 7/64	Positive PPD-S: On or after 7/64	Conversion in One yr, %
2nd	50	1	33	67.4
1st	46	3	23	53.4
O–1	59	3	17	30.3
Total	155	7	73	49.3

Table 4.—Percentage of PPD-S Conversion in Group 3

Division	Total	Positive PPD-S: Before 7/64	Positive PPD-S: On or after 7/64	Conversion in One yr, %
B	82	9	19	26
A	33	4	10	34.5
R	36	4	9	28.1
Total	151	17	38	28.3

culin reactivity rate among the 532 men subdivided into three groups went from 14.3 percent to 53.6 percent, and 209 men out of a possible 456 converted. This is an extraordinarily high rate of conversion among naval personnel in such a short period of time. The divisions showing the highest percentage of PPD-S skin converters numbered among their personnel patient 3 of E Division, patient 7 of S–2 Division, and patient 9 of the 2nd Division. The percentage of conversion in S–5 Division cannot be calculated, since all the men in that division had positive skin tests at the initiation of this study. (Patient 1 was from S–5 Division.)

The relative decrease in the total number of converters in other divisions is related to the distance of the various compartments from the ones where lived the original patients. Table 4 shows a significantly high percentage of PPD-S skin-test conversion in group 3 even though this group lived separately from both groups 1 and 2. This is explained by the close working relationships of the members of group 3 with those of group 1. Eventually, five men with active pulmonary tuberculosis were found in group 3, three of whom were asymptomatic and had negative roentgenographic findings but positive cultures for *M tuberculosis*. This again emphasizes the importance of studying the whole ship's complement in order not to overlook active disease carriers who are not only dangerous to themselves but potentially infective to others.

When the whole ship's complement was PPD-S skin tested, in July 1964, 74 men with positive skin tests were discovered among 563 men in the divisions not already described. This represents a conversion rate of 13.1 percent in the group not associated with the original cases. The same study repeated in April 1965 revealed a PPD-S conversion rate of 15.7 percent in the same group. Ochs in 1962 reported tuberculin reactivity rates of 12.3 percent, 13 percent, and 11.2 percent on three destroyers where personnel were not involved in a tuberculosis epidemic.

Analysis of the size of PPD-S skin tests in the 25 patients with active tuberculosis reveals that only six patients had reactions under 10 mm induration. Of the 334 men in this study with positive PPD-S skin tests and negative sputum and gastric-washing cultures, only 42 patients had reactions greater than 10 mm induration. Investigations have repeatedly shown the increased susceptibility to tuberculosis in young men with tuberculin sensitivity. Grzybowski and Marr demonstrated the peak risk of pulmonary tuberculosis in tuberculin-positive persons, both men and women, in the 20-year age group. Groth-Peterson et al demonstrated an age specific relationship of size of reaction to breakdown rate for the 15- to 24-year age group. Our study confirms that the larger the PPD-S reaction, the greater the risk of developing active tuberculosis in young men. Such a relationship was shown to continue in a five-year study among navy recruits by Palmer et al.

Judging from tuberculin reactivity of naval recruits and our own records prior to the outbreak of this epidemic, it is highly probable that at the time the first two cases were discovered, in June 1964, the majority of the men aboard ship had not been exposed previously to tuberculosis. Thus, those who developed active disease did so largely because they had no specific relative immunity. This lack of resistance, as well as the closed environment and airborne transmission, were probably responsible for the explosive nature of this outbreak.

It is evident that modern tuberculosis control must be aimed at early detection of those individuals who harbor the tubercle bacillus as evidenced by a specific reaction with standardized tuberculin testing. Our study shows that the asymptomatic individuals can shed *M tuberculosis*. Eight patients who were asymptomatic and had negative roentgenographic studies had bacteriological evidence of tuberculosis in either sputa or gastric washings or both. This again emphasizes the necessity of thor-

ough investigations of all converters. Although specialized procedures which may require hospitalization of the patient are expensive, they are of the greatest benefit for the individual patient and, in our study, contributed significantly to the eradication of the disease aboard ship.

Furcolow et al and Fuchs have formulated some priorities for the prophylactic treatment of patients in whom there is a susceptibility to developing tuberculosis. Because of the high frequency of PPD-S reactors in our three groups and the susceptibility to tuberculosis of the age group studied, a regimen of isoniazid was prescribed for all of the converters (daily prophylactic dose of isoniazid, 300 mg). The converters were returned to duty after clinical studies showed no active tuberculosis. In two patients, active disease developed three and five months following initiation of prophylactic chemotherapy. Close questioning of these two men revealed that they had stopped taking their isoniazid two and four weeks after the start of treatment. Follow-up studies on these two patients revealed that their cultures of *M tuberculosis* were not resistant to isoniazid. In a recent study, Curry demonstrated the effectiveness of isoniazid in preventing active tuberculosis in a large, school-age population. The administration of isoniazid to prevent the disease in recent converters played an important role in control of the disease aboard ship.

In any closed environment and where airborne transmission of disease is most probable, all contacts of patients with active pulmonary tuberculosis should be considered as "close" contacts. Thorough clinical evaluations of converters and appropriate chemoprophylaxis are the best preventive measures against the spread of tuberculosis in a closed environment.

(The omitted figures and references may be seen in the original article.)

PILONIDAL DISEASE

Robert M. Oneal, MD, and William C. Grabb, MD,
Univ Mich Med Cent J 33(6):270–273, Nov–Dec 1967.

The name, pilonidal, originates from the words, pilus, meaning hair, and nidus, meaning nest. It was first so-called in 1880; however, the lesion was described in the literature as early as 1833.

Pilonidal disease may present in a number of different ways, ranging from an asymptomatic cyst to a chronically draining lesion with multiple cutaneous openings. The clinical manifestations are usually seen in hirsute individuals in the second and third decade of life and are about twice as common in men as in women. There is less than the expected incidence of the disease in the Negro. It is rarely found in the Oriental or American Indian, both of whom have little body hair. The over-all incidence is unknown, but approximately 77,000 cases were documented among U.S. servicemen during World War II.

Because of its anatomic location and clinical characteristic of chronicity, the lesion has a high morbidity, which constitutes its main clinical significance.

Pathology

The lesion lies in or near the intergluteal fold, 3.5 to 5.0 cm. cephalad to the anal opening. The skin opening typically leads to an epithelial-lined tract directed cephalad. The tract may end in one or more sacculations which can communicate with the skin through other orifices. The cystic spaces are usually lined with vascular, pyogenic granulation tissue, but there may be patches of squamous epithelium. The cavity is often filled with hair, cellular debris, and purulent material.

Clinical Manifestations

The pilonidal lesion may be asymptomatic or may present as an acute abscess with cellulitis, fluctuation, and systemic manifestations. However, most cases present as chronically draining, painful sinuses.

If the process has been chronic or the infection severe, there can be multiple openings at unusual sites, for example, anterior and lateral to the anus. Consequently, it is possible to confuse a pilonidal abscess with a perianal one.

As is true of most chronic lesions, there is a chance of malignant degeneration in a pilonidal sinus. This has been reported, but the incidence is very low.

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Etiology

Since the logic of some treatment methods is predicated on the importance of total removal of the pathologic lesion, it would seem reasonable to establish whether the underlying pathology is really a congenital cystic structure. If it is not and actually is a chronic inflammatory foreign body reaction, then total removal (and its accompanying high morbidity and recurrence rate) might not be necessary.

Review of both clinical and pathologic studies lends considerable support for the theory of acquired origin.

Theories of Acquired Origin

Patey and Scharff in 1946 reported a pathologic state similar to pilonidal disease in the interdigital web space in the hands of barbers. Other reports of foreign body granulomas secondary to the subcutaneous presence of hair represent increasing evidence for a theory of acquired origin. This concept advances the idea that pilonidal lesions are foreign body granulomas developing in response to detached hairs which become imbedded in the subcutaneous tissue of the intergluteal fold.

Davage carefully reviewed the pathologic material of 463 cases of pilonidal disease and concluded that there was no evidence for associated skin structures such as hair follicles, sebaceous glands, or sweat glands in the sinuses, which would be expected if those lesions were truly congenital. Furthermore, the hair present was always "dead." The epithelium, when present, was near the skin opening and most of the deeper cysts were lined with vascular pyogenic granulation tissue. Foreign body giant cells and chronic inflammatory cells were frequent.

This careful pathologic study would indicate that the hair does not grow in the sinus from hair follicles present since birth, but originates from regional cutaneous hair-bearing areas. It has been suggested that coarse, detached hairs from hirsute individuals may actually be pulled through softened skin in the intergluteal fold by negative pressure produced by a rolling action of the buttocks. There may also be a drilling action of the stiff hairs as described in barbers. The presence of the hair then produces chronic inflammation and eventually the entity, pilonidal disease. The observation that there is more epithelium in the cysts with infections of longest duration supports the concept that the epithelium is not present from the onset but develops in response to the inflammation.

Theories of Congenital Origin

From the time of its original description, a congenital etiology for the pilonidal lesion has received much support. Three theories have been advanced:

The first proposes that the lesion is intimately associated with the development of the caudal end of the neurologic canal. However, neural tissue has not been described in the symptomatic pilonidal sinus, nor has the presence of cerebrospinal fluid been noted. A second theory places the origin in faulty development of the median raphe in the sacrococcygeal region. This leads to inclusion of dermal elements in the midline which should result in well developed squamous epithelium with accessory skin structures in the sinuses. A third proposal suggests that the condition represents inclusion of specialized tissue resembling the preen gland in birds. Neither of these last two theories is supported by analysis of microscopic sections of pilonidal lesions.

The sacrococcygeal dimple is a congenital invagination in the intergluteal area. It is quite common and is lined with epithelium. It does not, however, contain hair follicles or point in a cephalad direction. The progression of this lesion into pilonidal disease has not been convincingly demonstrated. It is possible that the cavity may trap hairs and other foreign material and be contributory to the development of the disease.

Treatment

Modes of treatment have varied with the popularity of the several theories of origin and with the stage to which the disease has progressed in the individual case. In the final analysis, the criteria for judging the effectiveness of a particular treatment must be evidence of a low recurrence rate and of a low morbidity. The latter is especially important since the disease afflicts an age group whose ability to continue to be economically productive is essential.

1. Total Excision and Primary Closure.—The rationale for this method presupposes a congenital origin and necessity for total removal of the lesion. Consequently, we feel that the underlying logic for this technique is open to question. In practical application it is safe to use only on small quiescent lesions without lateral extensions.

The advantages of the method are that it produces a short convalescence and, if successful, a complete cure. The disadvantage is that unless the lesion is small, there is usually tension in both the

skin and subcutaneous closure. This tension not uncommonly produces wound breakdown which, because of the placement of the wound in a potentially highly contaminated area, will result in a recurrence of the pilonidal disease. The reported recurrence rates vary between 10 and 25 percent from this method. When primary closure fails, a large open wound frequently results which can produce a high degree of morbidity and a long convalescence.

A method of musculofascial mobilization has been described to help close the wound following total excision and is reported to lead to a lower recurrence rate.

The authors feel that because of the high recurrence rate from this operation and because of the lack of logical rationale in its formulation, this is not the operation of choice.

2. Total Excision and Healing by Secondary Intention.—This method is also justified by the desire to remove the entire lesion. In this technique excision is carried down to the presacral fascia. The operative site is packed and allowed to granulate. Complete healing may require 30 to 60 days during which time the patient is frequently hospitalized and unable to work. Postoperative care must be extremely meticulous.

The recurrence rate has been reported to be as low as 4 percent and as high as 17.5 percent. The lower figure probably signifies stringent postoperative follow-up until healing is complete.

In general we feel that this, too, is a poor operation because of the extremely long convalescence. In selected cases convalescence can be shortened, if it is felt that this method is necessary, by the delayed application of a split thickness skin graft to the large granulating area. In carefully selected cases this has led to a permanent cure and marked reduction in convalescence.

3. Excision and Partial Closure.—In this instance the lesion is removed by an en bloc excision. The skin edge is sutured to the presacral fascia leaving a vertical length of fascia exposed in the center of the wound. If meticulous postoperative care is followed, the recurrence rate may be as low as 7 percent. Complete healing, however, may take as long as 12 weeks. We do not feel that this technique is the operation of choice because of the unnecessary wide excision and prolonged convalescence.

4. Exteriorization of Sinus.—With this method of treatment all the ramifications of the sinus or cyst are unroofed and all included foreign material is removed. The edges of the skin wound are then sutured to the base of the lesion. The postoperative healing period is less than that required with total excision, but is nevertheless measured in weeks. The resultant wound is smaller because the excision involves only the roof and side walls of the cavity. The theoretical disadvantage in this method is that abnormal tissue is left which might contribute to a high recurrence rate. However, reported recurrence rates using this method are low, from 2 to 6 percent. This method is a good one but only applicable to a well circumscribed cyst without wide-ranging subcutaneous ramifications.

5. Incision, Drainage, and Curettage.—This method is extremely simple and can be applied to all clinical stages of the disease. It was first described in 1854 and reported to have good results.

After the lesion and its ramifications are unroofed, all foreign material is removed and the walls and base curetted to remove the chronically infected granulation tissue. The patient is started on sitz baths the next day and usually can return to work within the first week.

This procedure is effective in dealing with the typical chronic lesion, but can be applied to the acute abscess as well. If wide incision and drainage are carried out under regional rather than local anesthesia, with evacuation of all foreign material and curettage of the entire lining, final healing should be possible in a significant number of cases. The necessity for secondary procedures, nearly always required after limited incision, should thus be greatly reduced.

With this technique the recurrence rate will approach 3 percent or less if there is adequate follow-up care. Included in the follow-up regimen is the institution of careful anal hygiene and attempted epilation, using frequent shaving, a cream, or radiation therapy. Since maceration of the skin, poor hygiene, and the presence of excessive hair are considered to be of prime etiologic significance, these adjunctive measures are of extreme importance in avoiding recurrence.

Even though the base of the cystic structure is left in place, the resulting wound is small enough so that final healing occurs relatively rapidly. Considering the underlying logic of this procedure, the low recurrence rates, the low morbidity, and shortened convalescence, this procedure appears to the authors to be the procedure of choice in most cases of pilonidal disease.

Summary

Pilonidal disease continues to be a surgical enigma. Its etiology has been controversial and

consequently the underlying rationale for treatment has been inconsistent. The evidence leading to a pathogenesis of a foreign body abscess seems justified in a review of the literature. If so, the simplest, most effective means of treatment would seem indicated. This may vary with the individual case and the ability and experience of individual surgeons. However, the results of incision, drainage, and curettage appear to us to best combine the advantages of low morbidity and recurrence rates as well as the least amount of time lost from work. We feel this more conservative approach might be considered in more cases of pilonidal disease.

(The references may be seen in the original article.)

COMPUTERS IN MEDICINE: WHERE DO WE STAND?

Arthur B. Callahan, Medicine and Dentistry Branch, Office of Naval Research,
Naval Res Rev 20(12):23–26, December 1967.

In this present technological age, increased utilization of computers is continually causing obsolescence of current data processing systems. Early computer systems enormously increased man's capability of handling data, making it necessary to develop faster and more versatile computers to keep up with scientific demand. Accordingly, time-sharing systems have been developed which permit multiple use of currently available computers and, consequently, increased user access. Another significant development is the analog-digital hybrid computer which allows the input signal to be pre-processed electronically before it receives final processing on the digital computer, with a resultant increase in speed. However, as evidenced by the vast amount of effort going into the development of both larger digital computer systems and special purpose computers, the technological appetite for increased computer capability has not been satisfied.

In this regard, the fields of biology and medicine have been as insatiable as all other scientific disciplines. An examination of the records of federal research granting agencies (by a computerized information retrieval system, of course) reveals that there are over 600 computer research projects in the biomedical field. When this "information explosion" is considered in terms of time, effort and expense involved, the questions which immediately arise are: what benefits are being derived from this effort, in what areas are the efforts being directed, and what are the envisioned results of these efforts? However, because of the widespread usage of computers and the great diversity of the research problems in which they are used, there are no clear-cut answers to these questions.

Computer Applications in Medicine

Medical computer applications have been classified into six areas: diagnosis, patient records, clinical laboratory analysis, patient monitoring, hospital communications, and facility utilization. A seventh area, statistical data handling, which could include most of the biological research applications, *e.g.*, curve-fitting, modeling, plotting, equation solving, *etc.*, can be arbitrarily established.

Although much has been published on the promises and potentials of computers in medicine, it must be admitted that computer application has not been as successful as had been predicted. It appears that computers have been most successful in the areas of clinical laboratory analysis and facility utilization, moderately successful in the areas of patient records and patient monitoring, and least successful in hospital communications and diagnosis. This arbitrarily established hierarchy of success parallels the decision complexity in the particular areas involved.

In the area of clinical laboratory analysis, the computer merely accepts a digitalized input signal from an instrument which measures a biological sample, *e.g.*, blood or urine, and records it in a standard laboratory record.

In the area of hospital facility utilization, computerization is primarily a bookkeeping function. Data pertaining to facility utilization, which includes patient population, housekeeping inventories, laboratory workloads, and the scheduling of treatment and diagnostic facilities, can constantly be entered into computer memory and then queried for status and availability. Such tasks obviously require minimal decisions from the computer.

The problem of automating patient record

storage and retrieval has received intensive effort from the medical profession. Automated access to vast numbers of patient records would seem to provide a clinical investigator with an invaluable source of research material for diagnosis and treatment of illness. However, putting a patient's record into machine-readable form has presented a formidable problem. Efforts directed towards coding existing patient records have been hampered by the vast quantities of records available, the heterogeneity of the information, and the ambiguity of clinical notations. Non-quantifiable notations such as "apparently normal" or "probably abnormal" are enough to drive an information retrieval specialist into a state of being "somewhat disturbed."

Patient monitoring involves attaching transducers to the patient and recording and analyzing the electrical signals received from the transducers. These recordings, which may be continuous or intermittent, indicate the patient's physiological condition. The current status of this condition may be obtained by querying the computer or a trend analysis can be obtained from the physiological data recorded over a period of several days. In monitoring special clinical situations, *e.g.*, cardiac intensive care, the system may be required to give an alarm if the patient's recorded values should exceed normal physiological limits. In such cases, the computer monitor system must be able to discriminate between genuine physiological trends and transient artifacts or instrument drift. Thus, the complexity of the task required of the computer system is greatly increased.

A similar situation exists in the area of hospital communications. In the integrated hospital communication system envisioned, the head nurse on the floor will have instant communication with other departments of the hospital which relate to patient care: pharmacy, patient records, treatment and diagnostic services, *etc*. The hospital communications systems now in existence are of the entry-query type: information is entered or requested from a console located at the nursing station. The envisional system will be extremely complex because of the vast variety of information which must be handled and the redundancy which will be required to avoid errors in diagnostic information or treatment orders.

Patient diagnosis is the area where the least overall progress has been made. Those computer applications in diagnosis that are being made are limited to special types of diseases which usually have a small number of easily quantifiable clinical indications. In cases where a large number of variables enter into a diagnosis, the computer system is assigned a decision function in which the particular variables are assigned a conditional probability, thereby increasing the complexity of the required system.

In the past, computerized diagnosis has not always seemed palatable to many physicians, primarily because it impinges directly on the fundamental role of a physician. In recent years, however, the medical profession has accepted the concept that the computer can serve as a diagnostic aid in the same sense that any piece of laboratory apparatus does. Such thinking probably reflects a trend where computers are no longer considered as anthropomorphic entities; rather, the medical profession has begun to realize that computers do have limitations.

Benefits Being Derived

Although computer applications in medicine have not lived up to early glowing predictions of revolutionary innovation, they have been very successful in many areas. In the field of patient monitoring, the development of improved sensors has enabled the physician to monitor physiological parameters more accurately and over longer periods of prognosis. Also, the data reduction capability of computers has diminished the laborious job of plotting data and performing statistical calculations. In this area, the development of small special-purpose analog-digital computers designed to measure respiratory mechanics or cardio-vascular changes has proven of great value. Many large hospitals are already equipped with cardiac monitoring units, and the National Institutes of Health are funding efforts towards developing improved models. Also in the area of patient monitoring, the Bureau of Medicine and Surgery is currently developing an automated shock-patient monitoring system for use in Vietnam.

Much progress has been made in the area of patient records. To illustrate, the Permanente Group, a group health insurance company in California, records the results of its subscribers' yearly physical examinations by computer. Much of the patient clinical data is accumulated by automated laboratory techniques. Similar automated laboratories exist in several hospitals throughout the country.

Hospital communications systems have advanced to the point where at least two companies, General Electric Medinet System and Control Data Corporation Hospital Communication and Information

Control System, are available commercially to hospitals which wish to subscribe.

As indicated previously, the introduction of computers in clinical medicine has required a more rigid quantification of diagnostic results for compatibility with computer requirements. However, this has not reduced the intangible science and art in medical practice; rather, it has introduced more rigid standards on which the physician can base his evaluation and diagnosis.

Much needs to be done before the early predictions become realities or before a national repository for medical records of all citizens which may be addressed from any hospital can be established. Computers have not substantially reduced the costs of medical care, nor have they been able to reduce hospital personnel. However, the impact of computers in medicine can be amply demonstrated to anyone who takes a behind-the-scenes look in any modern urban hospital. Practically every large hospital in the United States is using computers in at least one of the areas previously outlined and is actively exploring areas of increased computer utilization. Considering that the major effort in this field dates from 1959, it seems certain that even greater progress will be made in future years.

TICK PARALYSIS*—NEUROPHYSIOLOGIC STUDIES

Michael Cherington, MD,† and Russell D. Snyder, MD,‡
New Eng J Med 278(2):95–97, Jan 11, 1968.

Tick paralysis is an ascending flaccid paralysis caused by the bite of a tick and cured by removal of the tick.

We recently had the opportunity to examine a five-year-old girl with tick paralysis and to perform nerve-conduction studies. After reviewing the literature, we believe this to be the first case of tick paralysis in which conduction studies have been reported.

Case Report

A 5-year-old girl from western Colorado was in excellent health until May, 1967, when, within a 2-day period, a progressive, ascending quadriparesis developed. Speech became indistinct, and she had trouble swallowing. She was hospitalized elsewhere, and an engorging tick was removed from the left occipital region.

She was then transferred to Colorado General Hospital. General physical examination was within normal limits. The positive neurologic findings included nuchal rigidity, mild weakness of the upper and lower facial muscles, marked flaccid areflexic quadriparesis and an infrequent, generalized myoclonic jerk. A complete blood count, urinalysis, serum electrolytes (sodium, potassium, chloride, calcium and magnesium), blood urea nitrogen, serum cholesterol, serum protein electrophoretic pattern, serum glutamic oxalacetic transaminase, lactic dehydrogenase, creatine phosphokinase, cholinesterase (plasma and red cell), electroencephalogram, electrocardiogram x-ray film of the chest, cerebrospinal-fluid protein and cell count were within normal limits. During the next 2 days she improved dramatically, with the return of deep tendon reflexes and normal strength. She was discharged. Twenty-three days later she was re-examined and found to be completly normal.

Electric studies were done on the 2d and 3d hospital days and 23 days after discharge. Nerve-conduction tests were performed with the use of a TECA Model TE 1.2–7 electromyograph. Muscle-action potentials were recorded with surface electrodes over the right thenar muscle in the region of the motor end point (approximately midway between the proximal wrist crease and the line of the metacarpalphalangeal joint). Stimulating electrodes were placed over the vicinity of the median nerve at the wrist and at the elbow. A supramaximal stimulus was given, and conduction velocities were determined for the fastest fibers. The results, summarized in Table 1, show that motor-nerve conduction was slowed and the ampli-

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Supported in part by a grant (F. R. 69) from the United States Public Health Service and by a special fellowship (2F 11NB 1332–03 NSRA) from the National Institute of Neurologic Diseases and Blindness, National Institutes of Health, United States Public Health Service.

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tude of the muscle action potential was reduced initially. Both progressively returned to normal on 2 subsequent examinations.

Sensory-conduction studies also were estimated. Stimulating electrodes were placed on the index finger of the right hand, and recording electrodes placed over the median nerve at the wrist. Sensory latencies were normal each time (2.2 to 2.4 msec at a distance of 7.0 cm).

The median nerve was stimulated repetitively at rates of 2 per second before and after 10 seconds of muscle contraction. Neither technic produced any change in the amplitude of the muscle-action potential.

Table 1.—*Motor-Conduction Studies in the Right Median Nerve.*

Period of Measurement	Conduction Velocity *M/sec*	Amplitude of Muscle-Action Potential *mV*
2d hospital day	43.3	0.8
3d hospital day	47.6	4.0
23 days after discharge	50.0	12.5
Normal Range	47.0–64.0	6.0–14.0

Discussion

The clinical spectrum of tick paralysis has been described in several reviews. The findings of a flaccid, areflexic paresis, an engorging tick and a normal cerebrospinal fluid establish the diagnosis.

However, the exact mechanism by which the tick succeeds in producing the paralysis is not fully understood. Most probably, the tick injects a neurotoxin during the process of engorging. Recent neurophysiologic studies in animals suggested that the site of action of the toxin is in the vicinity of the neuromuscular synapse and that the toxin interferes with the release of acetylcholine. Murnaghan showed in dogs paralyzed by the application of the wood tick that a muscle that did not respond to indirect electrical stimulation of its motor nerve did respond when stimulated directly. In the same animal, he demonstrated that the motor-nerve fibers did conduct an impulse. These 2 facts seemed to establish that there was a failure of neuromuscular transmission in animals tested. He suggested that there was a conduction block of terminal motor fibers. In addition, experimental data revealed that conduction velocities are slowed in the motor-nerve fibers.

In the present study we performed serial electrical tests in a child who had tick paralysis. It is of interest that the patient's reflexes were completely absent on the initial examination. Early areflexia is a hallmark of peripheral nerve lesions, in contrast to the relatively late depression of reflexes in most disorders of the myoneural junction. It is of further interest that the electrical studies tended to support the clinical evidence of a neuropathic lesion. The data revealed the following: motor-conduction velocity was slowed and returned to more normal values in parallel with clinical improvement; repetitive stimulation of the motor-nerve revealed no fatigue and no defect of neuromuscular transmission (exercise did not have any facilitatory or depressive effect on the muscle action potential); and the amplitude of muscle-action potential, recorded with supramaximal stimulation of the motor-nerve, was quite small on the first day of study, when she was clinically weak, the amplitude increasing five times on the following day, when she had gained considerable strength, and over fifteen times the initial response one month later (the duration of the muscle-action potential was 10 msec on each occasion).

We interpreted these findings to mean that in clinical tick paralysis there is a slowing of motor conduction but not an alteration in sensory conduction of the peripheral nerve, and that there was no evidence of a defect of neuromuscular transmission such as that seen in myasthenia gravis, the myasthenic syndrome of Eaton and Lambert, in botulism or in neomycin toxicity.

The striking depression in the amplitude of the muscle-action potential requires further discussion. Normally, the amplitude is a measure of the number of innervated contracting muscle fibers. Its reduction might reflect lesions at 3 possible regions. First of all, a physiologic block of conduction of motor fibers of peripheral nerve could be responsible for the small amplitude; the rapid recovery of conduction velocity and amplitude of muscle action potential would not be consistent with Wallerian degeneration. Our data, however, do not rule out 2 other possibilities: a depolarizing block at the neuromuscular junction; or a lesion at the muscle. Combinations of these also might occur.

Summary

Peripheral nerve-conduction studies in a case of tick paralysis resulted in findings that are in agreement with certain earlier experimental data indicating that motor-nerve conduction is slowed. With clinical improvement, the muscle action potential amplitude increased markedly. Repetitive stimula-

tion failed to reveal any defect of neuromuscular transmission such as is seen in myasthenic states.

We are indebted to James H. Austin, M.D., Stuart A. Schneck, M.D., and Donough O'Brien, M.D. for assistance and to Vincent E. Gardner, M.D., for the referral of the patient.

(The references may be seen in the original article.)

HUMAN DISSECTION AND EXPERIMENTATION WITH DRUGS

SOME PROBLEMS AND PARALLELS

Harry F. Dowling, MD, JAMA 202(13):1132–1135, Dec 25, 1967.

Roger Bacon in the 13th century stated the dilemma of the physician-investigator thus:

The operative and practical sciences which do their work on insensate bodies can multiply their experiments till they get rid of deficiency and errors, but a physician cannot do this because of the nobility of the material in which he works.

Confronted with this dilemma, some investigators substituted speculation for experimentation, others sought answers from the lower animals, and a few used humans as subjects. How well were the rights of these humans respected? In Walter Reed's experiments, in the early studies of the therapeutic value of penicillin, streptomycin, and poliomyelitis vaccine, and in hundreds of others, investigators were scrupulous in consulting each person before the experiment was performed. But examples illustrating a contrary attitude can be found.

In 1836, a New Orleans physician wrote with regard to the shock-like state in cholera:

I have been informed by other physicians, that they observed the sensibility impaired to so great a degree, that boiling water poured on the skin was scarcely felt. . . . I poured boiling water on the legs of a Negro man in confirmed collapse, which he felt so acutely that he leaped up instantly and appeared to be in great agony.

A century and a quarter later, an investigator injected living cancer cells into the skin of patients in a chronic disease hospital. Because the nature of the experiment had not been explained to the patients, the regents of the University of the State of New York found him and the director of the hospital guilty of "fraud and deceit in the practice of medicine" and suspended their licenses (*Wall Street J*, Jan 21, 1966).

These experiments differ sharply from each other. The first was based on little evidence, was haphazardly planned, crude, and cruel. The second followed logically from studies that showed that both animals and cancer patients rejected foreign cancer cells; it was carefully planned, meticulously executed, and practically devoid of discomfort. Yet both lacked one essential element: the informed consent of the patient.

Thus the dilemma of reconciling the dignity of the individual with the demands of scientific discovery is still with us. In fact, it has been heightened in recent years by the increased number of new drugs, the sophisticated methodologies now used in studying drugs, the wide interest in operations for the transplantation of organs, the spotlight of politics in the form of congressional hearings, and the incorporation into written law for the first time of certain rules on experimentation with drugs in humans.

How do we find the answers to this dilemma? Only, I believe, by first gaining perspective. This can be obtained by looking at a parallel example in the history of medical science: the controversy over the dissectoin of the human body.

History of Human Dissection

We might start with the Greeks (where some people claim everything worthwhile began). The reverence of the Greeks for the human body was reflected in their insistence on proper burial after death. Rather than flaunt the higher law of the gods and leave her brother's body "unwept, unsepulchered, a welcome object for the birds . . . to feast on at will," Antigone chose to disobey the edict of King Creon, even though it meant that she herself would be buried alive.

From the Department of Medicine, University of Illinois College of Medicine, Chicago.

Read before the Washington Society for the History of Medicine, May 19, 1967.

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Many of the followers of Christianity likewise believed that the dead body should remain inviolate so that it would be intact on the Day of Judgment. Thus it was that the awakened thirst for knowledge of the Renaissance met with opposition when men tried to learn by dissecting the human body. A few bodies of criminals were made available, and since students sat in a lecture hall while the professor talked and a servant dissected, the shortage of cadavers was not acute, except among the artists, who, having no bodies assigned to them, made clandestine arrangements to obtain a supply directly from the hospitals.

The same practice of turning over the bodies of criminals to the barber-surgeons was begun in the British Isles in the 15th century. But popular feeling made it difficult to get the bodies of criminals, and eventually the supply was cut off almost entirely. Meanwhile, the founding of private anatomy schools accentuated the need for more anatomic material, and when the hospital schools of London began to teach anatomy in the 18th century, the shortage was greater than ever. Sometime during this period the practice of grave-robbing arose.

Ball claims that there were two classes of resurrectionists, as the grave-robbers were called: those who acted from a love of science and those who were "in it for the money." As the gap between supply and demand became progressively greater, the second group became more and more unscrupulous, callous, and brutal, until it seemed simpler to kill a victim and sell the corpse than to put in the work and risk the hazards of digging one up. These orgies culminated in the discovery of a series of murders by Burke and Hare in Edinburgh and by Bishop and Williams in London, the first in 1828 and the second in 1831. Warburton introduced a bill to eliminate grave-robbing in 1829, but it did not pass. The English merely shrugged off the tragedies in Edinburgh as examples of Scotch rowdyism, but, after Bishop and Williams had been caught in the same acts in London itself, a law was rushed through Parliament in a hurry. This provided for licensing of anatomic laboratories and the turning over of a certain number of cadavers to them.

The story in the United States was similar. At first there were few schools and few students enrolled in medical courses, and thus no great pressure for dissection. William Shippen began to teach anatomy in Philadelphia in 1763. His classes were often disturbed by rioters who were convinced that he was dissecting bodies obtained from cemeteries. In answer to these public protests, he announced that his subjects were either criminals, suicides, or "now and then one from Potter's Field." (The last apparently did not count.)

In New York City anatomy classes began in 1764, and grave-robbing soon became the order of the day (or, more literally, of the night). Walsh, in his *History of Medicine in New York*, says that practically all of the first six presidents of the New York Academy of Medicine confessed later in life that they had robbed graves during their student days. In 1788 rioting broke out in New York City, and for two days, in defiance of the militia, the rioters broke into the medical school, destroyed anatomic specimens, and would have killed the doctors if they had not been jailed for protection. Here also, violence was the prelude to legislation; and an act was passed the next year which provided that the bodies of those executed for murder, arson, or burglary could be turned over by the courts to the medical schools. At the same time, removal of a dead body without a permit was made a criminal offense. In 1790 Congress gave federal judges the same powers, but other states were slower to act. Riots occurred in Baltimore and New Haven, Conn, in 1820, in St. Louis in 1844, and a riot in St. Charles, Ill, in 1849 resulted in the wounding of a doctor and the death of a medical student. Indeed, after 60 years of rioting, the practice continued. In 1878, for instance, Benjamin Harrison, later to become President Harrison, searching the Ohio Medical College for the corpse of a recently buried friend, found to his horror the body of his own father, the late Senator John Scott Harrison. This incident, also, led to the passing of "anatomy acts" by the Indiana and Ohio legislatures the following year.

These riots and the clamor that arose whenever the public heard of the dissection of a body obtained from a grave, were symptomatic of the people's desire to keep the human body inviolate. They forced the passage of laws which had for their purpose the punishment of the offenders. Sometimes these laws also arranged for a more liberal supply of cadavers; often they did not, and the medical profession had to plead its case for several more decades until these were provided. By 1913 all of the states with medical schools, except Alabama and Louisiana, had laws making cadavers legally available for dissection.

It might be noted parenthetically that anatomic material is again becoming scarce, owing to increases in the numbers of medical students and the virtual elimination of the pauper class from our cities.

One way to meet the problem would be to impress people with the importance of study and research in anatomy, so that they would be willing to leave their bodies for these purposes. Another would be to curtail dissection and teach anatomy in large part from carefully simulated models of the human body. It will be interesting to see what the medical schools do about it.

But let us return to our comparisons. Viewed in retrospect, the era of grave-robbing had five characteristics: First, the dissecting of bodies was necessary to satisfy an urgent scientific need. Second, there were no lawful provisions for satisfying that need. Third, as a result, illegal methods were used to obtain bodies. The physicians, surgeons, and some of the medical students who took part were impelled by scientific curiosity, but most of the medical students, whose pockets were no better filled than those of medical students today, and all of the lay "body-snatchers" were "in it for the money." Both motives could lead to excesses, as when the noted surgeon, Robert Liston, stole the body of a giant from a country graveyard in broad daylight, or when Burke and Hare took the primrose path of murdering rather than the hard and risky path of digging.

A fourth characteristic was the dissimulation and suppression of facts by the medical profession. They believed they were doing right and so chose to take no one into their confidence. The final characteristic was the catastrophe that pushed the facts out into the open; these in turn forced the passage of a punitive law. Sometimes the law also contained the remedy, but often further struggles by the medical profession were needed before this was forthcoming.

Experimentation With Drugs

So long as the majority of the drugs in the pharmacopeia were worthless, such as thoroughwort, wild horehound, and isinglass (which appeared in the first United States Pharmacopeia of 1820), or downright dangerous (as was the powdered cow dung which Robert Boyle in the 17th century ordered his patients to put in their infected eyes), every use of a drug was an experiment and every doctor a potential investigator. If the patient did not relish such harsh and fruitless experiments, he chose not to consult a doctor, and many of them made this choice. Those who did put their trust in physicians could expect heroic treatments. But when microbiology and organic chemistry made the biologicals and the synthetic chemicals available in large numbers, many useful, potent drugs appeared and demanded careful delineation of their effects in humans and careful titration for the exact dose which would achieve the optimal therapeutic effect. Furthermore, now that drugs could do so much good, it was inexcusable that they should do harm if it could be prevented. Thus, monitoring for adverse reactions became necessary. And in recent years, clumsy comparisons of the effects of one drug with that of another, or with what one had observe would happen if no drug was given, began to give way to carefully planned, controlled experiments.

All of this was a gradual process, and even today, despite much progress, studies on drugs run the gamut from anecdotal case reports in which the patient's inadequately diagnosed disease is said to have "improved" on therapy to large-scale, rigidly controlled, double-blind experiments, some of which involve patients in many hospitals or many communities.

But as yet there is no state or federal law which legitimizes the trial of new drugs in humans, and there are no adequate precedents in the common law. What precedents there are would tend to make the practice illegal. The Food and Drug Act of 1938 required that the safety of every drug be proved before it could be marketed, and this necessitated trials in humans. The sweeping amendments to this act which were passed in 1962 required that the efficacy of a drug also be proved before it was marketed and at the same time required that the consent of the patient or subject be obtained before a drug that was under investigation could be administered, thus emphasizing again the dilemma in which science presses the accelerator and ethics applies the brakes.

A Parallel

The study of drugs in humans, therefore, resembles the first two characteristics of the conditions which underlay the episodes of body-snatching, that is, society demands that something be done but provides no legal means for it. The two situations have a third common characteristic. In both instances, the medical profession has done what it considered necessary for the advancement of science without saying anything about it. Because the patient is so anxious to get well and therefore trusts the doctor he has chosen, he seldom questions anything the doctor does. Occasionally a scandal breaks and protests are heard, as when a lay magazine (*The Nation,* June 29, 1921) rebuked the physicians who gave infants in an orphans' home a diet deficient

in vitamin C in order to study the scurvy thus produced; or when John Lear (*Saturday Review,* June 26, 1965) excoriated the investigators who had injected the cancer cells.

Another resemblance becomes evident when one sees how the medical schools were accessories after the fact and probably before the fact in the robbing of graves, how they must have known that their students were participating, and how they even "looked the other way" when there were evidences of trauma on bodies. In the recent past, the medical schools and the pharmaceutical companies have both been unwilling to police the administration of new drugs to patients. They have sometimes "looked the other way" at poorly devised experiments, and the medical schools have not always protested at false or misleading advertising of drugs which made improper claims on the basis of studies by their own faculty members. Also, I suspect that, like the presidents of the New York Academy of Medicine who had sober thoughts on their grave-robbing experiences in later life, some presidents of societies of clinical research, in looking back over their past studies on humans, could recall certain experiments which they wish they had not done.

Furthermore, in drug-testing as well as in body-snatching, the public had to enter the picture before satisfactory improvements were made. Fortunately for all, the discussions of experimentation on drugs have taken place mostly in the press and in congressional hearings, but there are signs that the public is becoming involved directly, as shown by "patients' societies" in England and in this country, which have protested the use of patients as "guinea pigs."

How Can the Problem be Resolved?

Young has shown that each of the important acts regulating food and drugs was preceded by a catastrophe. Before the 1906 law, it was the exposé of filth in the Chicago packinghouses in Upton Sinclair's novel, *The Jungle*, which overnight cut the sale of meat in half. Before the 1938 act it was the death of 106 persons who took the so-called elixir of sulfanilamide, and before the 1962 act was passed the thalidomide disaster struck. Given the differences in the way the public shows its emotions today, it is making its will known as convincingly as it did in the riots that preceded the enactment of the laws regulating dissection.

But violent public reactions alone will not achieve sensible and beneficial laws. Someone has to work for them, preferably those most knowledgeable and most intimately involved. J.B. Blake (personal communication) has shown that the law passed in Massachusetts in 1831, the first law in the English-speaking world which deliberately set out to provide a satisfactory supply of cadavers for dissection, resulted from the intensive efforts of Harvard Medical School and the Massachusetts Medical Society extending over six years. These involved (1) willingness to bring the problem into the open, (2) a deliberate attempt to change the attitudes of the public by giving them the straightforward facts and showing them that they would benefit rather than the medical profession, and (3) lobbying in the legislature when necessary. Similar tactics were employed in New York, Pennsylvania, Ohio, Illinois, and elsewhere, whereas in the District of Columbia, where the medical profession did nothing, a remedial law was not passed until 1895. There are those who counsel with respect to human experimentation, "Don't rock the boat." Yet we already have a restrictive law pertaining to the administration of new drugs to humans, and regulations imposed by the National Institutes of Health requiring grantees to obtain peer approval of human experiments—and there is no law on any statute book which makes human experimentation legal.

Can we learn from history? I believe we can, if we do not demand exact parallels but can see analogies and differences where they exist. The dilemmas accompanying dissection and drug-testing are enough alike to make me believe that the latter, like the former, will be near a solution now that it has been brought into the open. Knowing, then, the identity of and reasons for these competing forces, scientific research and human dignity, the medical profession can set about the job of bringing them into a productive equilibrium. If we can do this, we have met the test of a successful society.

Dr. Dowling is a Health Sciences Scholar, National Library of Medicine, Public Health Service (PHS 1–F13–26, 400).

(The references may be seen in the original article.)

MEDICAL ABSTRACTS

SURGICAL TREATMENT OF DIVERTICULITIS:

TWENTY YEARS' EXPERIENCE

Bentley P. Colcock MD, Amer J Surg 115(2):264–270, Feb 1968.

During the last twenty years, 294 patients have been operated on at the Lahey Clinic for diverticulitis. The indications for surgery were perforation, obstruction, fistula, recurrent attacks of the disease, and occasionally the inability to rule out carcinoma. Of this group, 61.2 percent had one stage resection. There were seven deaths and the over-all mortality was 2.38 percent. The mortality for 180 patients who had primary one stage resection was 1.6 percent. There were no deaths in the fifty-seven patients who had a three stage resection. This mortality is reasonable, but it could have been less. Much of the remaining morbidity associated with the surgical treatment of diverticulitis is caused not by the too frequent use of a three stage procedure but by complications occurring after one stage resection for patients with perforation or obstruction.

ASPIRIN AND GASTROINTESTINAL BLEEDING

R. H. Salter MB BS BSc (London) MRCP, Amer J Dig Dis 13(1):38–58, Jan 1968.

In view of the widespread use of aspirin (acetylsalicylic acid) in clinical medicine over many years, the realization that it can be a significant factor in the causation of both occult and manifest bleeding from the gastrointestinal tract was slow to be appreciated. In an extremely comprehensive and critical review of the salicylates published in 1948, Gross and Greenberg were able to conclude that:

Bleeding from the gastrointestinal tract may occur in exceptional cases after small doses of salicylate and is probably due to an abnormal sensitivity. Bleeding, frequently observed after toxic doses of salicylate, is due solely to a systemic action of salicylates, since it also occurs in other mucous and serous membranes and is related to disturbances of the prothrombin of the blood.

How far the position has changed since then can be judged from the following statement by Lasagna, in the course of a discussion on the choice of a mild analgesic:

"In recent years, the dangers of aspirin poisoning secondary to overdosage and the rare dramatic allergic response to salicylates have been overshadowed by the unmistakable evidence that salicylates can have topical corrosive effects on the gastrointestinal tract. Although bleeding is usually associated with the continued ingestion of substantial amounts of drug, salicylate-induced gastric haemorrhage of catastrophic proportions can be elicited by the ingestion of even one or two tablets. Such bleeding may be dramatic or subtle, and can exist with or without obvious gross ulceration."

This review considers the evidence for the association of aspirin with occult and overt bleeding from the gastrointestinal tract, the nature and site of the aspirin-induced lesion, and possible mechanisms concerned in its production.

CLINICAL AND EPIDEMIOLOGIC IMPACT OF PENICILLINS OLD AND NEW

G. T. Stewart MD, Pediat Clin N Amer 15(1):13–29, Feb 1968.

As therapeutic substances, penicillins gained new importance in 1959 with the discovery that their antibacterial and pharmacological usefulness could be widened by semisynthetic procedures involving the isolation of the common molecular nucleus 6-aminopenicillanic acid (6-APA) (Sakaguchi and Marao, 1950; Batchelor et al., 1959), and the consequent practicability of varying side-chain structure. This discovery—which came in a series of small steps, not accidentally as did the original discovery of penicillin—was applied in therapeutic practice in 1959 with remarkable despatch at a time when problems of antibiotic resistance and hospital-based infection due to staphylococci were showing signs of being almost insurmountable, so that the impact of discovery, for the second time in the history of penicillin, was obvious and immediate, as well as life-saving. This repetition of history and therapeutic importance has kept penicillin in the forefront of antibiotic development but only because, underlying these events, the antibiotic itself possesses unique properties, whose study amounts almost to a special branch of chemical biology. In this article, the medical uses of the penicillins are presented from this wider angle,

since usage and conservation depend upon an understanding of the biologic origin and function of the penicillin molecule.

SUDDEN DEATH AND PHENOTHIAZINES: A CURRENT CONTROVERSY

J. E. Leestma MD and K. L. Koenig, MD, Arch Gen Psychiat 18(2):137–148, Feb 1968.

In recent years many clinicians have become increasingly troubled over reports of sudden unexplained death occurring in psychiatric patients being treated with phenothiazine tranquilizing drugs. Most cases reported are young, in apparent good health, on fairly high doses of one or more of the phenothiazines, and often, in spite of the level of administered dose, difficult to control. Patients may drop to the floor unconscious, in shock or cardiac arrest, and often have severe cardiac arrhythmias; they aspirate food or gastric contents; or they may be found dead in their rooms without signs of an agonal struggle. Generally, autopsies on such patients are not helpful in fixing an anatomic cause of dealth. Three possible mechanisms for death have been suggested: cardiac arrhythmias and arrest; sudden catastrophic hypotension; and asphyxia due to aspiration. These sudden death reactions are said to be unpredictable and unpreventable.

Relatively few of these cases have been reported in relation to the tremendous numbers of patients receiving phenothiazine tranquilizing drugs since their use became widespread. As a result many have stated that there has been no increase in the numbers of sudden and unexplained deaths in psychiatric patients since the introduction of phenothiazines and that so-called phenothiazine sudden death may be spurious. Others, on the basis of some recently described cardiovascular side effects of the phenothiazines, firmly believe that under certain circumstances phenothiazines can and do cause a sudden fatal reaction.

The authors also inquired into possible actions of phenothiazines at tissue, cellular, and molecular levels which could account for sudden death.

DENTAL SECTION

RIDGE PRESERVATION WITH IMMEDIATE TREATMENT DENTURES

W. D. Loo, J Pros Dent 19:5–11, 1968.

Much information has been contributed to the literature regarding the exact duplication of the natural teeth in size, shape, form, and position in the construction of immediate dentures. The esthetic quality of an immediate denture can be perfected to such details as replacing tobacco stains, enamel etchings, dental restorations, and even dental abnormalities. However, very little has been offered or suggested on how to effectively accommodate the immediate denture to the early reparative changes that follow extraction. The problem is perplexing since the denture is static in nature and the process of healing, in the early stages especially, is a constant physiological alteration of the underlying alveolar structures.

The author describes a technique he has successfully employed in over 100 clinical cases using immediate treatment dentures. He constructs the dentures with a shim that provides space for the addition of soft resins that are easily replaced. This allows the basal surface of the dentures to be changed at frequent intervals so that the shape of the denture can be altered to follow the changes in the form of the tissues of the basal surface as healing progresses. The soft lining material also provides a desirable intermittent physiological stimulation to the underlying ridge tissues, conditioning and preserving these tissues in a normal healthy state for the reception of a second denture.

(Abstracted by: CDR W. D. Loo, DC USN.)

PERSONNEL AND PROFESSIONAL NOTES

CLINICAL INDIRECT DENTAL PULP CAPPING EVALUATION STUDY

Histopathologic studies of dental pulp responses to indirect pulp capping procedures in deep carious lesions of young male naval personnel are being conducted at the Great Lakes, Naval Dental Research Institute. This study includes long-term

clinical evaluations. Upon completion of treatment an evaluation questionnaire is inserted in the patients dental record folder. It is desired that all dental activities be alerted to such patients reporting into their activity and arrange for clinical evaluation to be performed in December 1968 or as soon thereafter as practical. The questionnaire forms are to be completed and returned immediately to the Pathology Section, Naval Dental Research Institute, Building 600, Naval Training Center, Great Lakes, Illinois 60088.

ORAL SURGERY ACTIVITIES IN THE NAVAL DENTAL CORPS

The conflict in Vietnam has increased the requirements for oral surgery support by the Dental Corps of the U.S. Navy.

Oral Surgeons are assigned to various dental companies, station hospitals, aircraft carriers and hospital ships deployed in SEASIA.

When not occupied with the treatment of Navy and Marine Corps personnel, the oral surgeons are active in the support of the Civic Action Program along with the other dental officers assigned to SEASIA. Vietnamese civilians are treated for a wide variety of pathologic conditions. In addition to the extraction of numerous teeth and other types of routine oral surgery, the correction of cleft lips and palates has been performed.

The incidence of maxillofacial wounds in Vietnam is somewhat a matter of conjecture at this time and possibly will not be accurately determined until this conflict is history. Although facial wounds which result in a loss of tissue substance represent but a small percent of all battle injuries, the total number is significant and the rehabilitation of these patients is of major concern. The oral surgeon has an important role in the Navy's multidisciplined approach to this problem. The team also includes the maxillofacial prosthodontist, speech therapist, and psychiatrist, as well as the other surgical specialists.

The Navy's oral surgery training program has been increased in response to current demands. During fiscal year 1968 twenty-four dental officers received formal training in this specialty. Six of these officers were in postdoctoral fellowships. Eighteen officers were in one of the three graduate training years leading to certification by the American Board of Oral Surgery.

Dental officers who are graduate students in oral surgery at the Naval Dental School, undertake research projects at the Naval Medical Research Institute as part of their didactic training program. During the past year, two of these officers presented the results of their work at International Dental Research Meetings.

A large portion of Navy oral surgery research is concerned with the direct support of the Vietnam maxillofacial casualty treatment program. Patients who have sustained avulsive-type wounds with extensive bone loss frequently require large gap-spanning bone grafts and present problems in surgical management. A major segment of the current oral surgical research effort, being carried on at the Naval Medical Research Institute, is directed toward the development of more effective bone grafting techniques and fracture immobilization methods.

Research in bone repair is influenced by two areas of immediate clinical concern:

(1) The need for the development of a readily available graft material for use in major, extensive traumatic injuries of the facial bones. Such a development has been made necessary by the demands of the Vietnam effort on the Tissue Bank at the National Naval Medical Center.

(2) The need for the evolution of more effective implant materials and surgical techniques for the restoration of inflammatory, atrophic and degenerative alveolar defects in older naval personnel.

The evaluation of a detergent treated lyophilized heterogenous material has been completed in a test system involving reconstruction of edentulous mandibular defects of dogs. Intravital tetracycline labeling has demonstrated retarded rates of long-term osseous remodeling of these onlay implants. Repetitive grafting with this material has indicated enhanced rejection of second set implants. The results of these studies fail to support the clinical use of this material.

Reevaluation of freeze-dried homogenous bone in various test models is continuing in an effort to increase the production of acceptable osseous graft material for the Tissue Bank. The combination of autogenous marrow with acceptably preserved bone homografts is also being investigated. Such combined transplants appear to offer excellent opportunity for the development of clinically acceptable grafts with enhanced osteogenic potential.

(Prepared by: CAPT H.B. Marble, DC USN.)

WRIGHT HOSTS TIDEWATER NAVY DENTISTS

During *National Children's Dental Health Week,* the USS WRIGHT (CC–2), was host to the largest group of Navy Dental Officers ever assembled at one time aboard a ship. It was most fitting that Rear Admiral Maurice E. Simpson, Dental Corps, the Commander in Chief, U.S. Atlantic Fleet for Dentistry and over sixty dental officers from ship and shore installations attended a special luncheon on board the Navy's number one Command ship.

A wardroom luncheon, prepared by members of WRIGHT's award-winning chefs, treated the dental officers to the finest Navy food. A briefing and slide presentation by Captain F. M. Romanick, commanding officer of WRIGHT, and Lieutenant Commander Robert W. Koch, the ship's dental officer, illustrated the WRIGHT's missions and civic action programs during the past year.

The professional group toured the ship and praised the most modern dental facilities afloat as they passed through the completely refurbished dental department.

The following day, WRIGHT's dental assistants worked "hand in hand" with dentists stationed at the Naval Dental Clinic, Norfolk, applying stannous fluoride to dependent children of WRIGHT's crew.

This year, *National Children's Dental Health Week* left an everlasting impression upon the memories of both the Navy Dental Corps and the crew members of the USS WRIGHT.

JOURNAL NEEDS

The Naval Dental School needs the following copies of the *Journal of Prosthetic Dentistry:*

1967	Vol. 17	Nos. 1,2,3,4,5,6
1967	Vol. 18	Nos. 1,2,3,4,5,6

If anyone has any or all of these editions and would donate some to the School, please forward to the Commanding Officer, Naval Dental School, National Naval Medical Center, Bethesda, Maryland 20014.

DENTAL TECHNICIAN SCHOOL REQUESTS EXCESS SUPPLIES

Review of Dental Technician School teaching materials reveals shortages of the following listed supply items:

Artificial Teeth—Any odd shades or molds
Pontics, Facings, and Backings
Zinc Phosphate Cements
Silicate Cements
Any other excess supplies appropriate for teaching purposes in the Class "A" and Class "C" Dental Technician Schools.

It is requested that dental activities forward the above listed items to:

Commanding Officer
Naval Dental Center
Naval Base
San Diego, California 92130

NURSE CORPS SECTION

NURSES UNDER THE SEA—PART I

LT Patricia Fellenz, NC USN.

There is an aspect of clinical and investigative medicine that is somewhat unfamiliar not only to the average layman but to a good many people in the medical profession as well. Yet because of present day research and experimentation it will be increasing in renown over the next decade to take its place as a speciality in medicines. This is known as Hyperbaric Medicine. Hyperbaric oxygenation is oxygen therapy applied within a pressure chamber under circumstances which provide alveolar partial pressures of the gas exceeding those possible from the inhalation of pure oxygen at atmospheric pressure. The resultant hyperoxemia produces elevations in tissue tensions of oxygen.

The concept of the "breath of life" is actually an ancient one. Yet the idea that the air breathed by man had any role in the living process was not seriously considered until 300 years ago in the middle of the 17th century. In 1667 Robert Hooke spoke these words before the Royal Society of London:

> "An aerial something, whatever it may be, and essential to life, passes into the mass of the blood. Thus, the air driven out of the lungs, the vital particles drained from them, is no longer fit for breathing again."

A few years later, in 1674, John Mayow identified this "aerial something" that supports combustion as a specific component of air that he called spiritus nitro-aereus".

If, indeed, an "aerial something" was essential to life, it was natural to conclude that appropriate modifications in the concentration of air breathed by patients might be effective in the treatment of their diseases. Therefore we can see that Hyperbaric oxygen therapy is not an achievement of the past decade; rather its present status reflects developments and hinderances during hundreds of years. It begins in the distant past with man's initial exposure to hyperbaric conditions through diving in quest for food, treasures, escape, and pleasure.

Breathing of pressurized air by divers submerged with an inverted metal vessel was discussed by Aristotle as far back as 350 B.C. In 1782 the Haarlem Academy of Science in Holland attempted to foster interest in hyperbaric work by awarding a prize for an apparatus to study the effects of high pressures on biological systems. No contenders came forth until 1834 when a French scientist named Junod built a small trial chamber.

Based on the work of the early French scientists compressed air was used in the air supply for caisson workers as early as 1841. This initiated the simultaneous exposure of more than one person to hyperbaric conditions within a single apparatus. At that time physicians noted that men who worked for 7 hours at a depth of 65 feet developed pains in their arms and knees shortly after emerging into the surface air. This became known as "Caisson's Disease" or as it is known today "The Bends".

The term "The Bends" was coined during the construction of the Brooklyn Bridge in New York City. The victim would assume a peculiar position to alleviate his symptoms of pain in the joints and because of this posture was kidded by fellow workers as having the Grecian Bends, referring to a fashionable walk affected by women of the time. Ancient Greek statues had been discovered showing court jesters doing the "Grecian Bends".

Interest quickened as technicological progress provided means by which man could work under increased pressures in Caissons, tunnels, diving bells, and diving dress. In ten short years chambers had spread all across Europe and by 1855 several fashionable French chambers had begun to attract patients from all over Europe and America. By 1880 a mobile hyperbaric operating room had been built so that surgery could be performed in the patient's home or in a hospital. However 5 years later interest had wained in the clinical applications of such hyperbaric therapy and only a few physicians continued research in the field. The accidents and illnesses associated with increasing exposures of persons to elevated pressures eventually caused a focusing of attention upon the physiologic aspects of hyperbaricity.

Paul Burke was one of the first to go into a detailed study of the effects of various gas mixtures on man. His work led to the present day gas mixtures which allow man to make deep ocean descents and not suffer from the toxic effects of nitrogen gases. The study of gas solubility and embolism by Holdane was the basis for the establishment of safety rules regulating decompression rates adopted by the British Admiralty in 1907 to minimize decompression sickness. The United States Navy Diving Manual is our current directive of decompression procedures and is a valuable aid to both military and civilian chamber operations.

In 1891 the first hyperbaric chamber in the United States was built in Rochester, N.Y. During the 1920's quackery took hold of hyperbaric therapy and a large 88 foot chamber was built in Kansas City. This was subdivided into rooms much like a hospital wing and fantastic claims were made for the therapeutic results obtained. The owners claimed the successful treatment of: anemia, amenorrhea, anorexia, conjunctivitis, deafness, diabetes, syphilis, viper bites, and many more. In 1928 as notoriety and therapeutic claims increased, a Cleveland, Ohio industrialist by the name of Cunningham built the ultimate chamber 5 stories high with 12 bedrooms on each floor. Without proven substantial medical gains the popularity of such therapy fell into disrepute and the remaining chambers were used for the treatment of deep sea diver's bends only, until the recent developments of the 1960's.

LT Patricia Fellenz, NC USN, presented a paper on "Nurses Under the Sea" as a panel member discussing "Innovations in Federal Nursing" at the 1967 annual convention of the Association of Military Surgeons of the United States.

The basic theory behind the use of oxygen under pressure is actually very simple. By administering 0_2 at an increased ambient pressure the quantity of L_2 dissolved in the plasma, and subsequently in all body fluids, is increased. This provides an equivalent higher oxygen tension at the cellular level throughout the entire body. It also serves to increase the body's reservoir of oxygen.

The designation of pressure in terms of atmospheres absolute represents conventional hyperbaric terminology. Its consistent use in relation to hyperbaric oxygenation is urged to avoid errors. Ambient pressure at sea level is regarded as one atmosphere absolute or approximately 15 lbs per square inch. Gauges designed to measure pressures register ambient sea level pressure as zero. Thus a registered pressure of 1 atmosphere or 15 psi on a gauge is actually 2 atmospheres absolute.

As a rule it has been found that the amount of oxygen dissolved in body fluids increases approximately 2.3 Vol % per atmosphere of increased pressure. Breathing room air at 1 atmosphere absolute the arterial blood contains 19.5 Vol % of 0_2 with approximately 0.25 Vol % dissolved in the plasma. By breathing 100% 0_2 at 2 ATA the plasma 0_2 is increased to 4.2 Vol % or almost double.

(To be concluded in No. 9 of 10 May 1968.)

AEROSPACE MEDICINE SECTION

MASS CASUALTY HANDLING ABOARD CARRIER—PART III

Based on a letter from LCDR A. J. Adeeb, MC USN, Medical Officer, USS ORISKANY, concerning casualties from fire and explosions aboard the USS FORRESTAL on 29 July 1967. Part II of this series (Vol 51, No 4, 23 February 1968) described the casualty handling aspects of this episode as seen aboard the USS FORRESTAL.

At approximately 1055, 29 July 1967, explosions and fire aboard the USS FORRESTAL resulted in extensive damage to that ship and a casualty list that at last count included 134 dead, and 162 injured. The ORISKANY being the closest large ship, immediately dispatched two Airwing Flight Surgeons, one Dental Officer and ten Corpsmen via helicopter to assist the medical personnel aboard the FORRESTAL. Within ten minutes of the initial explosions four injured personnel were retrieved from the sea by helicopter and brought to ORISKANY. All four had severe burns—3 litter patients and one ambulatory. It rapidly became apparent that additional medical personnel were required on board the FORRESTAL. The ORISKANY Senior Medical Officer and 5 Corpsmen departed via helo approximately 30 minutes after the first group.

Aboard the FORRESTAL, fires were being actively fought. The two ORISKANY Flight Surgeons were in charge in the forecastle where a casualty receiving station had been established. Approximately 40–50 patients were in this area, many critical, including burns, shrapnel wounds, traumatic amputations and severe head injuries. These doctors worked admirably under arduous conditions with the help of a FORRESTAL Dental Officer, 3 Corpsmen and about 20 non-medical personnel.

Below, in sick bay spaces, ORISKANY and FORRESTAL Senior Medical Officers agreed to evacuate as many patients as possible to the ORISKANY in order to relieve the overcrowded conditions. Accordingly, patients who were severely burned but ambulatory were brought to the flight deck. Litter cases followed as well as assorted shrapnel wounds and fractures. The evacuation to ORISKANY was handled by a seemingly endless string of helos.

During the first two hours, ORISKANY sick bay was manned by one Surgeon, two Dental Officers, and the remaining Corpsmen. The Surgeon, who had been on board during the ORISKANY fire, initially concerned himself with triage and directed the efforts of the Dental Officers and Corpsmen. The Medical Service Corps Officer directed the identification and tagging of patients, and the Supply Corpsman was making available further supplies in anticipation of mass casualties. Marines were primarily utilized as stretcher-bearers, and other non-medical personnel with some previous para-medical training (in one case a naval aviator

who was a former Army Medic) lent a sorely needed hand.

By approximately 1330 some 30 patients had filled ORISKANY's sick bay. Blood donors from the walking blood bank were immediately available and utilized. (This is almost an automatic function during any emergency involving serious, traumatic injury.) At this time the Senior Medical Officer had returned from the FORRESTAL and continued the job of triage, thus freeing the Surgeon for more definitive procedures. By 1530, 42 patients had been brought to ORISKANY and at this time the Airwing Flight Surgeons, the Dental Officer, and the ORISKANY Corpsmen had returned from the FORRESTAL. Shortly thereafter a medical team from INTREPID arrived consisting of two Flight Surgeons and 4 Corpsmen. During this period congestion was the greatest, and the space problem confronting the Medical Department was severe. Many major procedures had to be performed on the actual decks of sick bay by the ship's Surgeon, but relatively sterile fields were maintained. Both the main operating room and the treatment room operating room were continuously utilized. Due to the outstanding efforts of the operating room Technician and the Supply Corpsman, needed equipment was immediately cleaned and re-autoclaved so that at no time during the entire period was there a pause due to needed surgical tools.

By approximately 2000, all serious patients had received some form of definitive therapy. Minor wounds were being attended to and preparations were underway for evacuation of the critical and serious to the USS REPOSE which was on a rendezvous course with the carriers. All patients were tagged, each had a chart, and when the word was passed, the evacuation process was conducted in an orderly, efficient manner with outstanding cooperation from the Marines as stretcher bearers. Patients were transported from sick bay level, (2nd deck on ORISKANY) directly to the flight deck via #4 bomb elevator. From the flight deck they were heloed to the USS REPOSE with the Flight Surgeons rotating as escorts. By 0500, 30 July 1967, all critical and serious patients (25 in all) were transferred to the USS REPOSE and the clean-up work began. Sixteen patients remained. One patient expired.

Summary and Comments

At 1055, 29 July 1967, explosions and fire aboard the USS FORRESTAL resulted in 134 deaths and 162 injured. Of these the ORISKANY treated a total of 42 injured patients—11 critical (one expired on the operating room table) 15 serious, and the remainder, minor. Patients were handled expeditiously although lack of adequate operating space was one of the more serious problems at times. ORISKANY medical personnel varied in numbers from one Surgeon, two Dental Officers, and 9 Corpsmen during the early hours to a full staff plus two Flight Surgeons and 4 Corpsmen from the USS INTREPID.

In viewing the events of that day and the following day, several points are to be stressed as being critical to any mass casualty handling. Of course, the ORISKANY was fortunate in this instance, in that the fire and explosion did not threaten the ship as it did in October 1966.

To enumerate, then, the following is emphasized: (1) *Supplies*: The standard recommendation for supplies is Initial Outfitting List (IOL) plus 9 months. *Comment*: The Medical Department was completely stocked and although many supplies were located in the storerooms, they were brought out in anticipation of mass casualties. It is felt that this was a definite life-saving factor. (2) *Operating Facilities*: Two operating room tables were available, plus one examining table in the passageway and one examining table in the Aviation Examining Room. The x-ray table was also utilized. *Comment*: Originally, the ORISKANY had one rather old operating table. The treatment room boasted of an ancient, concave-shape examining table. Just prior to deployment a brand new Shampaine table (sans motor) arrived. The original operating room table was placed in the treatment room and the old examining table was placed in various areas as needed during the cruise. It served admirably as a blood donor table in front of the laboratory during this period. It is highly recommended that all carriers be equipped with two operating tables, or more, if space permits. (3) *X-Ray*: The ORISKANY x-ray unit (a 100 MA, 100 KVP Picker) was adequate. *Comment*: The x-ray department was an occasional bottleneck. As often as not the x-ray table served as an operating room table. However, the x-ray technician performed magnificiently and the job was accomplished in spite of the unit being old and at times unreliable. Repeats of film due to poor quality (inherent in the ORISKANY's unit) caused undue delay on several occasions. The recommendation for new improved units must be stressed. (4) *Operating Room*: The operating room Technician had primary responsibility for the sterilization and procurement of medical hardware. In addition, his as-

sistance during surgery was mandatory. *Comment*: A competent operating room technician is a must. No one less than outstanding should be assigned to this work. The ORISKANY operating room Technician served in an exemplary manner. During the cruise he had trained several (three) other Corpsmen in the finer points of operating room technique. These skills proved invaluable that particular day. (5) *Laboratory*: Eleven units of fresh whole blood were used. The lab Corpsman worked incessantly and almost independently. *Comment*: Blood was available when needed. The "walking blood bank" has been commented upon earlier. (6) *Corpsmen*: They performed in an outstanding manner to the last man. *Comment*: Training is the key. Rotation of Corpsmen through all areas, necessarily cumbersome at first, improves the efficiency of the entire Department. Repetition in training, although tiresome, nonetheless pays off handsomely when the actual situation exists. (7) *Maximum Utilization of Paramedical Personnel*: The Dental Officers and Dental Technicians are a valuable asset to any mass casualty situation. *Comment*: Burn and wound debridement, suturing and dressing of burns and wounds, all tedious and time consuming, were conscientiously performed by the Dental Officers, thus freeing the Medical Officers for the more complex surgical procedures. (8) *Maximum Utilization of Non-Medical Personnel*: The ORISKANY chaplains were a source of comfort to many patients. In addition they would monitor IV's and thus free Corpsmen for more demanding jobs. Marines were an invaluable source of manpower in stretcher-bearing and errand running. *Comments*: As a rule, many individuals have served as "medics", etc., in other branches of the service including the Navy. A simple request early in the cruise for this type of information can be a source of potential medical manpower. One obvious problem is the possibility of saturating sick bay spaces with personnel. Marines remained instantly available in the ship's passageways and were called upon as required. Space to move about is of paramount importance, especially on 27-C Class carriers. (9) *Ward Patients*: They were returned to their respective division (no seriously ill patients were on the sicklist at the time). *Comment*: Some of the ward patients were helpful in that they monitored IV's on the burn patients. However, as more patients arrived, they were returned to their bunks as SIQ or outpatient status. Again, working space is at a premium. (10) *Evacuation*: The ability to rapidly evacuate patients is extremely important. *Comments*: The only thing better than sending the patient to the hospital is having the hospital come to the patient. The mobility of the REPOSE and SANCTUARY is undoubtedly the greatest medical asset in this area, not to mention their wonderfully complete facilities. On board a carrier, long-term care of a great number of seriously injured personnel can be difficult. This is due to the frequent understaffing of Corpsmen, the lack of adequate nursing facilities, and the medical operational requirements of the ship. In addition, lab studies such as vital chemistries are difficult or impossible to do because of inadequate laboratory space. In a majority of instances the vibration and noises of 27-C Class carriers can be detrimental to the patient in that adequate rest may not be obtained. In addition, the various movements and vibrations can be painful in severe fracture or burn cases, necessitating inordinate amounts of narcotics. (11) *Triage:* This is a necessary aspect of military mass casualty handling. *Comment*: ORISKANY was extremely fortunate to end up with the services of 6 Medical Officers (two of whom were Surgeons) and 4 additional Corpsmen. This allowed definitive limb and life-saving procedures to be performed. At one point 3 Medical Officers operated for 2 1/2 hours on a critically injured patient who otherwise may have expired under the triage system. This occurred later in the day (around 1700) when all patients were aboard and the situation was tolerable.

INFLUENZA EPIDEMIC ABOARD A U.S. NAVY AIRCRAFT CARRIER

Background.—Influenza is a viral disease which usually occurs in unprotected populations with waves of high incidence every two to three years. Beginning in the late fall of 1967 and continuing into the early winter months of 1968, influenza has been widespread throughout the central and eastern United States, and also has been reported in many other countries around the world. To date, there have been very few reported outbreaks of influenza from ships or shore stations in the U.S. Navy.

In January 1968 an aircraft carrier with an air group aboard deployed for two weeks operations. An epidemic of influenza-like illness involving all divisions of the ship and all squadrons aboard oc-

curred during this deployment. The clinical picture of illnesses reported by the Medical Department included the following: fever, dry cough, headache, chest ache, rhinorrhea and general malaise. Respiratory symptoms predominated although some patients did have gastrointestinal symptoms of diarrhea, nausea, vomiting and abdominal cramps. The cases of influenza-like illness reportedly occurred first in personnel of the air group the day following deployment, and within 2–3 days additional cases were occurring in the ship's company. The illness outbreak reached its peak approximately one week after onset and was subsiding by the time the ship returned to home port.

Information obtained from the Medical Department of the ship indicated that cases occurred both in personnel who had received influenza vaccine and in those who had not received the annual immunization. In the United States Navy, annual influenza immunization is a requirement for all personnel who are not allergic to egg or chicken protein. At the request of the CINCLANT Fleet Surgeon, a representative from Preventive Medicine Unit No. 2 visited the ship and the shore station where the air group was stationed to obtain information concerning the effectiveness of the influenza immunization in this population.

Findings.—The average strength for the aircraft carrier's ship's company was 1,598 men. The air group had an average strength of 646 personnel including 111 pilots. The total population at risk aboard the ship was estimated to be 2,244 personnel. The total cases reported by the ship's Medical Department for the ship's company and the air group was 217, an incidence of 9.6%. From actual sick call records there were 178 cases recorded which is an overall attack rate of 7.9%. Eight men were admitted to sick bay as in-patients. It was estimated by the ship's Medical Department that there were approximately 100 cases of influenza-like illness who did not report to sick bay for treatment.

In the ship's company of the aircraft carrier there were 71 cases, an attack rate of 4.4% for the ship's company. The 107 cases from the air group personnel gave an attack rate of 16.6%. Thus the attack rate in the air group squadron personnel was nearly four times the rate for the ship's company personnel.

A total of 147 health records were located and checked for prior influenza immunization in personnel who had been sick with influenza-like illness. In the ship's company, 32 of the 71 ill patients (45%) had not received an influenza immunization during the past year. In the 76 ill patients from the air group whose health records were available there were 71 (93%) who had not had influenza immunization in the past year. Only health records of sick patients who had been seen by the Medical Department for influenza-like illness were studied by the representative from Preventive Medicine Unit No. 2. However, it was estimated by the Senior Medical Officer of the aircraft carrier that slightly over 50% of the ship's company had received influenza immunizations. Information from two of the squadrons of the air group indicated that *only a very small percentage had received their annual influenza immunization.* This may explain the higher attack rate in the squadron personnel.

During the two-week deployment there was a total of 49 pilots from the air group who were grounded. Some pilots were grounded for a number of days and the total number of man-days lost was 246, an average of 5 man-days per pilot. Seventeen other personnel who were on flight status were grounded for a total of 77 man-days lost in this group. A total of 66 flight personnel (10.7%) were grounded during this period for a total of 123 man-days lost, an average of 4.9 man-days lost per person. The attack rate in pilots of the three squadrons of the air group ranged from 35 to 48 percent. The specific illness attack rate for pilots was 44 percent.

There was some indication from the records that perhaps those personnel who had received their annual influenza immunization were not as severely affected from the illness as those who had not been immunized and subsequently were ill with influenza-like symptoms. To examine this effect of the immunization on the severity of illness an objective medical measurement was studied. That is, those patients' records were studied who had been seen at sick bay and who had their temperature recorded in the health record during their acute illness. Of the total of 97 patients with a temperature recorded in their health records, 35 had shown an influenza immunization within the past year while 62 had not had a current influenza immunization. A temperature of 100° F or greater was the criterion for a fever. Twelve patients who had a current influenza immunization had temperatures in the range of 100° F or greater. Forty-three of the 62 patients who had not had a current influenza immunization showed a temperature above 100°. The percentage of patients who had a fever but were without a current influenza immunization was approximately twice as great as those in the im-

munized group with a fever. The highest recorded fever which was noted during the illness in any patient's record was 104.8° F. This occurred in a patient who had not received his annual influenza immunization.

Average Personnel Strength Figures	
Ship's Company	1,598
Air Group	646
Total	2,244

Air [illegible]up	Pilots of Air Wing
163	25
158	28
iS 241	45
VAW 76	12
CAG 8	1
Total 646	111

Cases of influenza-like illness reported by ship: 217

Cases Based on Sick Call Records only	
Ship's Company	71
Air group personnel	107
Total	178

Grounded Flight Personnel of Air Group (4 through 18 January 1968)		
Pilots	49	246 man days lost
Others	17	77 man days lost
Total	66	323 man days lost

Attack Rates	
Ship and Air Group combined	7.9%
Ship's Company only	4.4%
Air Group	16.6%
Flight Personnel Grounded	10.2%
Pilots Grounded	44.3%

(*AeroMed Editor's Comment:* It should go without saying that Commanding Officers interested in maintaining Operational Readiness will *order* their personnel to take immunizations required by BUMED Directive or other competent medical authority.)

Comments.—Many of the statistical findings are based on relatively small numbers of personnel. However, these data suggest that the attack rate of influenza-like illness was higher in those population groups where the number of personnel who had received the annual influenza immunization was low. The air group had a much higher attack rate than did the personnel of the ship's company who were better immunized. The pilots from the air group had a high attack rate of illness (44%) with a significant number of man days lost, possibly affecting the operational status of the squadrons.

Febrile illnesses, as based on an objective measurement (recorded temperatures), were significantly higher in personnel without a current influenza immunization when compared to febrile patients in the immunized group. This indicates that the severity of the influenza-like illness was favorably modified by having a current influenza immunization. The difference in the numbers of patients with fever in the group with a current influenza immunization as compared to the group without a current influenza immunization is statistically significant by the Chi square test ($P<0.01$), using a correction factor for small numbers.

(From a letter by CDR W. E. Frazier, MC USN, Officer in Charge, Navy Preventive Medicine Unit No. 2, Norfolk, Virginia 23511.)

HAZARD OF CORNEAL BURNS FROM TONOMETER

To Whom It May Concern:

I saw Mr. L. W. in my office on 18 November 1967 with severe bilateral eye pain, photophobia and tearing. He gave a history of having had a Reserve physical examination, which included tonometry, at the Air Station Dispensary that morning. Symptoms began on his way home.

Examination revealed bilateral, deep, central, circumscribed sloughing of the corneal epithelium. The left eye was more extensively involved, showing stromal edema and folds in Descemet's membrane.

At first, I thought that the above was due to a chemical sterilizing agent that had not been thoroughly removed from the footplate of the tonometer, but after careful review of the technique as described by the patient and by a fellow Reservist who also had a physical that day, I feel that *heat sterilization was used and that the tonometer was not allowed to cool sufficiently before being applied to the cornea.*

Currently, after repeated patching and topical medications, the right eye has healed completely. The left cornea is covered and the cornea edema has subsided, but there is still some irregularity of the epithelium. This should clear with time although he may be subject to recurrent erosions at the site.

I am writing this for inclusion in the subjects record, and also to alert the staff concerning the

incident so that steps may be taken to prevent a recurrence.

(*AeroMed Editor's Comment:* This case report is published to alert Flight Surgeons, aviation examining personnel and others of the real hazard which exists when improper technique is used following heat sterilization of the tonometer. A similar incident has occurred before and resulted in *loss of vision in one eye* of the patient involved.

The Bureau strongly recommends that this information is brought to the attention of all personnel concerned with physical examinations and tonometry, and that the procedure be performed only by trained professional personnel. Besides the medical aspects of such a tragic accident, the Medico-legal implications are vast.)

NOTES FROM AEROSPACE MEDICINE DETAIL OFFICER

Flight surgeons who have problems relative to their work are encouraged to call or write to the Bureau of Medicine and Surgery for informational purposes and for such assistance as may be available. However, the local Senior Medical Officer should be informed as to the matters discussed, since Bureau response is invariably official in nature and will return via the C.O. and SMO.

Flight surgeons are requested to inform their SMO's about matters which they intend to take up with the Bureau, and get his permission to write or call. Very often his concurrence or opinion is required before the Bureau can act. Considerable time can be saved if he is cut-in at the beginning. There are exceptions to this policy, but in general it should be observed. In isolated instances, where there is no SMO available, the local Commanding Officer should be consulted, particularly in matters concerning change of duty and when relief is required.

On 1 January 1968 there were 460 designated Flight Surgeon billets, and on that date there were 490 flight surgeons, including 49 graduates en route as replacements for flight surgeons being released from active duty, resulting in nineteen unfilled billets.

To replace flight surgeons who left the service on completion of obligated duty, those who resigned or retired, and those released to take up residency training in other specialties, 49 medical officers were graduated as flight surgeons from the Naval Aerospace Medical Institute at the Naval Aerospace Medical Center, Pensacola, Florida, during the past six months. The Institute also graduated three officers of the Army Medical Corps during this period. The total number of flight surgeon/naval aviators on active duty as of 31 December 1967 was 17. One flight surgeon completed the full course leading to the designation of naval aviator in September 1967. One flight surgeon is enrolled in the complete course leading to the designation of naval aviator, one has been approved for a refresher course of flight training in anti-submarine warfare leading to the reestablishment of his status as a naval aviator to begin in February 1968, and one will commence the complete course in the summer of 1968.

One naval aviator/flight surgeon commenced instruction at the Naval Test Pilot School, Naval Air Test Center, Patuxent River, Maryland, in October 1967.

Two Navy flight surgeons are under orders to the Aeromedical Department, Naval Aviation Safety Center, Naval Air Station, Norfolk, Virginia, to complete the final six-month period of the two-year Aerospace Medicine Residency which commenced at the Naval Aerospace Medical Institute.

A request has been received for a quota to be allocated to the Commandant, United States Coast Guard, for a Public Health Service officer to begin his second year of residency training in Aerospace Medicine in July 1968 at the Naval Aerospace Medical Institute, Pensacola, Florida. This officer successfully completed the Aerospace Medicine Course on 18 December 1963 and will complete his first year of residency training at the University of California during June 1968. Approval has been recommended.

An Army flight surgeon, presently in Residency Training in Aerospace Medicine at the Naval Aerospace Medical Institute, Pensacola, Florida, was granted approval to spend a 60–90 day period aboard a CVA deployed in the combat zone in Southeast Asia as a portion of this training.

Since the flight surgeon previously assigned to the Naval Station, Midway Island, was relieved by a general medical officer, the Naval Air Station, Barbers Point, has been requested to assist in the aeromedical coverage required by that activity. It was necessary in the past to establish the same type of support between Barbers Point and Kwajalein.

On 23 October 1967 an arrangement was made with the Commanding Officer, Naval Aerospace Medical Institute, to increase the input into the Flight Surgeon Program by ten students per class. This was necessary because the present output is insufficient to fill existing authorized billets which

now number twenty-six. It is probable that this increase will be recruited for the July and September classes, but not likely for those which convene in January. It is anticipated that this additional input will enable us to catch up with the requirement by April of 1969. This may mean that we will have to ease our visual requirements for applicants somewhat, and grant an increase in waivers, but these would be limited to highly motivated and recommended applicants.

This Bureau was represented at a "Conference on Specialty Training in Aerospace Medicine" which was hosted by the Ohio State University and chaired by the Secretary of the American College of Preventive Medicine. At this Conference an address entitled "Training and Utilization of United States Naval Flight Surgeons," together with the film "Doctor on the Flight Deck," was presented by the Navy representative, Captain W. M. Snowden, MC USN. This was a working conference on the requirements for Residency Training in Aerospace Medicine. The participants represented the U.S. Army, U.S. Navy, U.S. Air Force, National Aeronautics and Space Administration, Federal Aviation Administration, commercial airlines, and the aerospace industries.—AeroMed, BuMed.

EDITOR'S SECTION

TEACHING MACHINE WORKSHOP AT NAVAL MEDICAL SCHOOL

A fifteen pound electronic device for individual learning was the subject of a workshop conducted at the Naval Medical School from 29 through 31 January. Arranged by CAPT John H. Stover, Jr., Commanding Officer, Naval Medical School, the workshop was conducted to acquaint a pilot group of Medical School instructors with the techniques of preparing programmed materials for a special purpose teaching computer called the DIDACTOR.

In announcing the workshop CAPT Stover said, "We expect to develop for the Naval Medical School and in-house capability to prepare our own programmed instructional materials for various individualized teaching machines such as the Didactor. These techniques form an excellent introduction to programming courses for full scale application of the Computer Assisted Instruction (CAI) technique of learning."

Pointing out that the Didactor can be used on shipboard as well as in the field, CAPT Stover added, "If the experiment is successful it means we will have a small scale computer learning device programmed with material that has been developed to our own needs by our own instructors. This will give us a significant degree of economy in the utilization of the system. It will obviate the necessity of turning instructional material over to special teams of programmers."

The workshop was conducted by Mr. Jack W. Hannah and Mr. George C. Harmon, President and Vice President respectively of the Didactics Corporation, Mansfield, Ohio. Attendees included staff instructors of the Radioisotope Technique, X-Ray Technique and Laboratory Technique courses.

CAPT Stover said the machine attracted his interest because it is simple to operate and very little time is spent in teaching the student to use the machine. He said the machine has been in use in the United States for about four years and there are now some 3,500 units in operation with over 450 programs available. These involve basic skills training as well as special skills training. A sensor matrix of twenty-five receptors permits great flexibility for "branched" programming as well as activating audio-visual devices. Memory circuits tally errors and may be set to automatically require the student to repeat sections he has not satisfactorily grasped.

"I believe this is the first effort along this line by any of the military services," CAPT Stover said, "and it holds great promise for medical subject matter within the Navy." He went on to say, "Individualized study is recognized as being the technique for improving education and training in the future. Industry has found that it really pays off. The operating features of this machine make possible large economies in the cost of our training programs at the Naval Medical School, and may well permit accelerated completion of courses by the more gifted members of our student population." —Public Affairs Office, NNMC, Bethesda Md.

TWO NEW MANUALS AVAILABLE

CAPT John H. Stover, Jr., MC USN, Commanding Officer, Naval Medical School, NNMC, Bethesda, Maryland, has announced the availability of

two new Naval Medical School publications from the Government Printing Office—the "Medical Entomology" manual, catalog number D206.6/3:EN8/967, Price $2.00, and the manual "Some Harmful Plants of Southeast Asia," catalog number D206.6/3:PS96, Price $.45. These two, as well as the following Naval Medical School publications, may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402:

"Medical Protozoology and Helminthology"
Catalog No. D206.6/3:P94/965, Price $1.75.

"Manual of Gynecological Exfoliative Cytology"
Catalog No. D206.6/3:C99, Price $1.75.

"Clinical Laboratory Procedures, Bacteriology and Mycology"
Catalog No. D208.6/3:813, Price $1.75.

The Tri-Service publication, "Laboratory Procedures in Blood Banking and Immunohematology," Catalog No. D101.11:8-277-3, Price $2.00, is also available.—Public Affairs Office, NNMC, Bethesda, Md.

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NOTICE TO MEDICAL OFFICERS

The Navy has a number of residencies available to qualified applicants in the fields of anesthesiology, pathology, surgery, thoracic surgery, and internal medicine. Training is to begin in the summer of 1968. Interested applicants should direct inquiries to the Bureau of Medicine and Surgery (Attention Code 316).

In Memoriam

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RADM Lucius W. Johnson MC USN (Ret)

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